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IS 2103 (1980): Engineer's Squares [PGD 25: Engineering Metrology]

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(Reaffirmed 2006)

IS : 2103 - 1980

Indian Standard

SPECIFICATION FOR ENGINEER'S SQUARES

(Second Revision)

Engineering Metrology Sectional Committee, EDC 43; Gauges Subcommittee, EDC 43 : 3 [Ref: Doc: EDC 43 (3174)]

1. Scope — Covers the requirements of engineer's squares of three grades of accuracy, namely, Grades A, B and C.

1.1 Engineer's squares of sizes 500 mm and above may be provided with a flange as shown in Table 1.

1.2 It does not apply to adjustable blade squares.

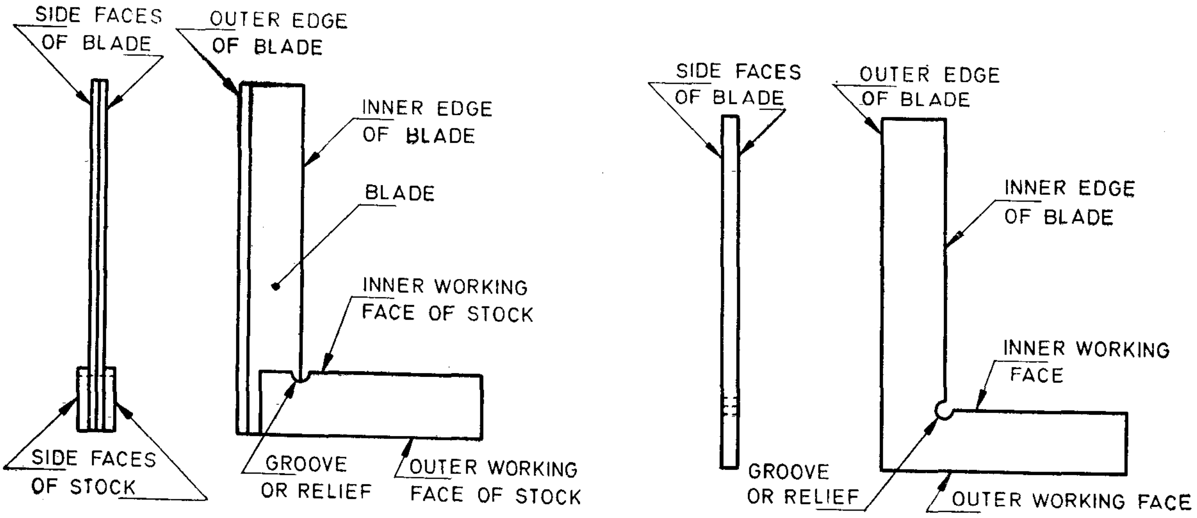
2. Nomenclature and Definitions — The nomenclature indicated in Fig. 1 along with the definitions given in **2.1** to **2.3** shall apply.

2.1 *Tolerance on Straightness* — The maximum permissible distance separating two imaginary parallel planes within which the surface under consideration can just be enclosed.

2.2 *Tolerance on Parallelism* — The maximum permissible distance separating the two imaginary parallel planes within which the surfaces under consideration can just be enclosed. The imaginary parallel planes are parallel to the datum face in question.

2.3 *Tolerance on Squareness* — The maximum permissible distance separating two imaginary parallel planes within which the surfaces under consideration can just be enclosed. The imaginary parallel planes are perpendicular to the datum face in question.

3. Dimensions — The dimensions of squares shall be as specified in Table 1.



Type 1 Bevelled Edge with Stock

Type 2 Flat Edge Without Stock

FIG. 1 NOMENCLATURE FOR ENGINEER'S SQUARES

Adopted 29 September 1980

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Price Rs 8.00 Gr 4

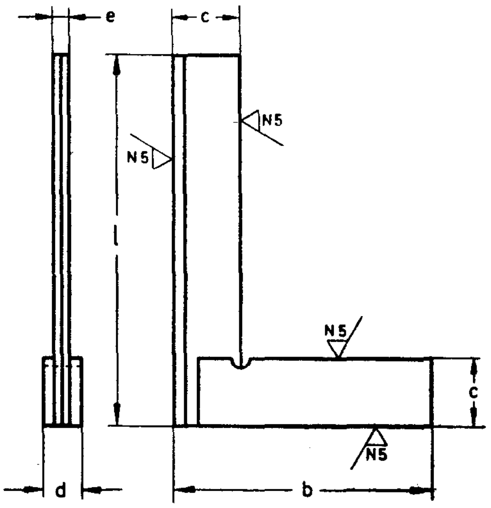
INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

TABLE 1 DIMENSIONS FOR ENGINEER'S SQUARES

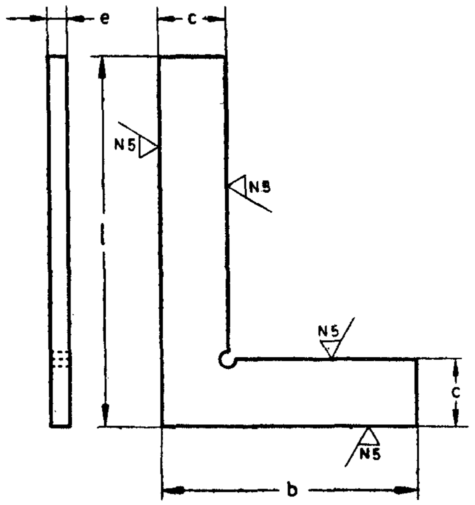
[*Clauses* 1.1, 3, 5.1(a) *and* 7.1]

All dimensions in millimetres.

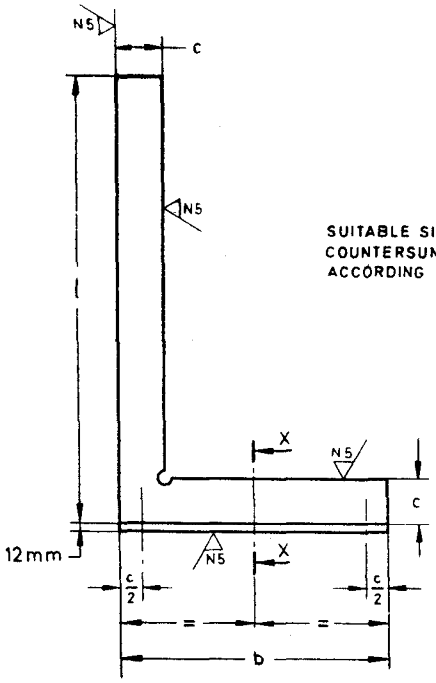
N8 (N5)



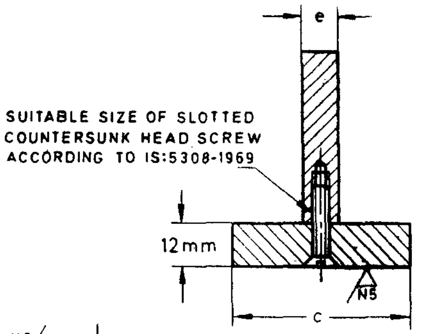
Type 1 Bevelled Edge with Stock



Type 2 Flat Edge Without Stock



Type 3 Engineer's Square with Flange (500 mm and Above)


e
SUITABLE SIZE OF SLOTTED COUNTERSUNK HEAD SCREW ACCORDING TO IS:5308-1969
12mm
N5
c

ENLARGE SECTION XX

Size and Designation Length of Blade *l*	*b*	*c*	*d**	Thickness of Blade *e*	
				With Stock	Without Stock
50	35	12	8	3	4
100	70	18	10	4	5
150	100	25	12	4	6
200	140	30	15	4	6
300	200	40	20	5	8
500	300	50	25	6	10
750	500	60	30	8	12
1 000	750	80	40	8	12

* These dimensions are applicable to engineer's squares with stock only.

4. Accuracy

4.1 *Perpendicularity Tolerance for Internal and External Angle Square* (*see* Fig. 2) — The perpendicularity tolerance of inner and outer working faces to the inner and outer edge of blade respectively to be taken from the fromulae given in Table 2. The length *l* to be taken in mm.

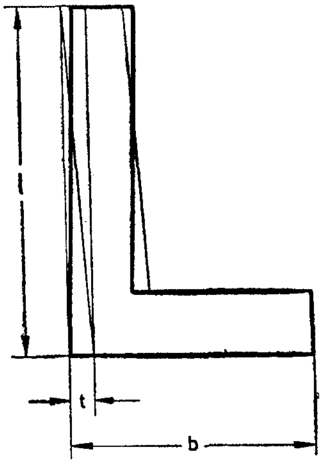


FIG. 2 TOLERANCE FOR INTERNAL AND EXTERNAL ANGLE SQUARES

TABLE 2 FORMULAE FOR PERPENDICULARITY TOLERANCE FOR WORKING FACE TO EDGE OF BLADE

(*Clause* 4.1 and *Fig.* 2)

Grade	Perpendicularity Tolerances t in µm
A	$2 + \frac{l}{100}$
B	$5 + \frac{l}{50}$
C	$10 + \frac{l}{20}$

Note — The rounded-off values calculated based on the formulae given in Table 2 are given in Table 3.

4.2 *Parallelism Tolerance* — Parallelity tolerance of edges of blade is three times the values given for the perpendicularity tolerance for working faces given in Table 3. The parallelity tolerance of side faces is three times the values of perpendicularity tolerance given for working faces in Table 3.

TABLE 3 PERPENDICULARITY TOLERANCE

Length *l* mm	Perpendicularity Tolerance t in µm		
	Grade A	Grade B	Grade C
50	3	—	—
100	3	7	15
150	4	8	18
200	4	9	20
300	5	11	25
500	—	15	35
750	—	20	43
1 000	—	35	85

Note — The perpendicularity tolerance of side face at blade to working face of small angle arm is three times the values given in Table 3.

4.3 *Flatness Tolerance or Straightness Tolerance on Bevel Edge* — The flatness tolerance on working face and straightness tolerance on bevel edge is calculated according to the formulae given in Table 4. The dimensions of l_n (l and b) are in millimetres.

TABLE 4 FORMULAE FOR FLATNESS AND STRAIGHTNESS TOLERANCES

All dimensions in millimetre.

Grade	Flatness and Straightness Tolerance in µm
A	$2 + \frac{l_n}{250}$
B	$2 + \frac{l_n}{100}$
C	$4 + \frac{l_n}{50}$

Note — The rounded-off values calculated based on the formulae in Table 4 are given in Table 5.

TABLE 5 FLATNESS TOLERANCE AND STRAIGHTNESS TOLERANCE VALUES

l and b mm	Flatness and Straightness Tolerances in µm		
	Grade A	Grade B	Grade C
50	2	3	5
100	2	3	6
150	3	4	7
200	3	4	8
300	3	5	10
500	—	7	14
750	—	10	19
1 000	—	12	24

Note — For the flatness tolerance of side faces, three times the values given in Table 5, for flatness of the working face shall be taken.

5. Designation

5.1 All squares shall be designated by:

a) Nominal length of the blade in millimetres, measured from the outer working face of the stock to the end of the blade (dimension *l* in Table 1);

b) Grade of accuracy A, B or C;

c) Type 1, 2 or 3 representing bevelled edge with stock, flat edge without stock or engineer's square with flange respectively; and

d) Number of this standard.

5.2 *Grade* — Unless otherwise specified, Grade A squares shall be supplied with bevelled edges and Grade B and C squares with flat edges.

Examples:

a) Engineer's square of blade length 200 mm, Grade A and Type 1, that is, 'with stock' shall be designated as:

Engineer's Square 200 A-1 IS: 2103

b) Engineer's square of blade length 300 mm, Grade B and Type 2, that is, 'without stock' shall be designated as:

Engineer's Square 300 B-2 IS : 2103

c) Engineer's square of blade length 500 mm, Grade C and Type 3, that is, 'with flange' shall be designated as:

Engineer's Square 500 C-3 IS : 2103

6. Manufacture — The squares shall be of good quality tool or alloy steel suitably hardened and stabilized. The measuring surface shall have a minimum hardness of 660 HV [*see* IS : 1501-1968 Method of Vickers hardness test for steel (*first revision*)].

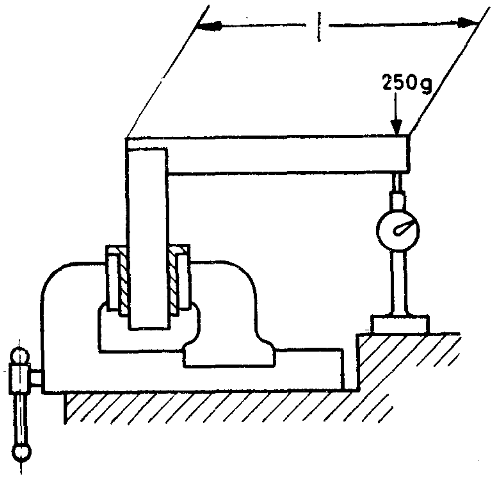
6.1 Suitable examples of steel from IS : 1570-1961 'Schedule for wrought steel for general engineering purposes' are given below:

Sl No.	*Designation*	*Schedule for IS : 1570-1961*
1	T215 Cr 12	Schedule VI
2	T150 Cr 1 Mn 60	
3	T105 Cr 1	
4	T 90 V 23	Schedule IV
5	17 Mn 1 Cr 95	
6	20 Mn Cr 1	

7. Workmanship and Finish

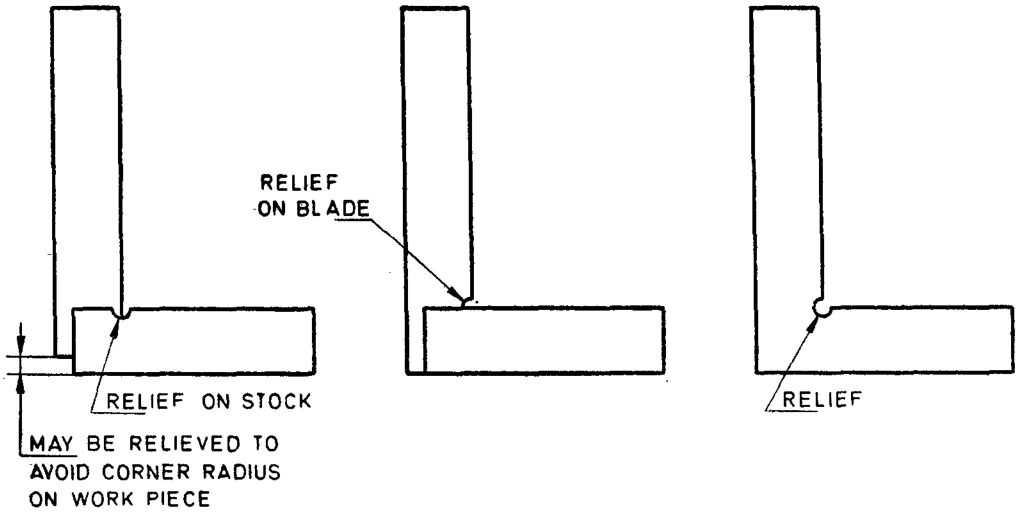
7.1 All working surfaces, edges and sides of the blades, stocks and flanges shall be carefully ground and lapped. The surface finish value shall be as indicated in Table 1.

7.2 *Rigidity* — The blade shall be rigidly and permanently fixed in the stock or the flange by suitable means. When it is held rigidly as shown below, and a load of 250 g is applied to the end of the blade, the end of the blade shall not deflect by any amount greater than 0·7 $\sqrt{l}$ μm, where *l* is the length of the blade in millimetres.



7.3 The squares shall be free from cracks, pits and other flaws. All sharp edges shall be removed and surfaces shall be bright all over. The rivets and screws used for joining the stock or flange to blades shall be flush with faces or the working surfaces of the squares.

7.4 The stock or the blade shall be slightly relieved across the width at the junction of the inner faces of the stock and blade as shown below. The outer junction of the blade and the stock may also be relieved as shown in the figure to avoid corner radius on work-piece.



7.5 *Bevelled Edges for Grade A Square* — Grade A squares shall be supplied with both inner and outer edges of the blade bevelled, so that the approximate width of the bevelled edges is as follows. The included level angle size shall be a approximately 60 degrees (*see* Fig. 3):

Size of Square	*Approximate Width of Bevelled Edges*
Up to 100 mm	0·2 mm flat or radius
150 and 200 mm	0·5 mm flat
300 and 500 mm	0·8 mm flat
750 and 1 000 mm	1·2 mm flat

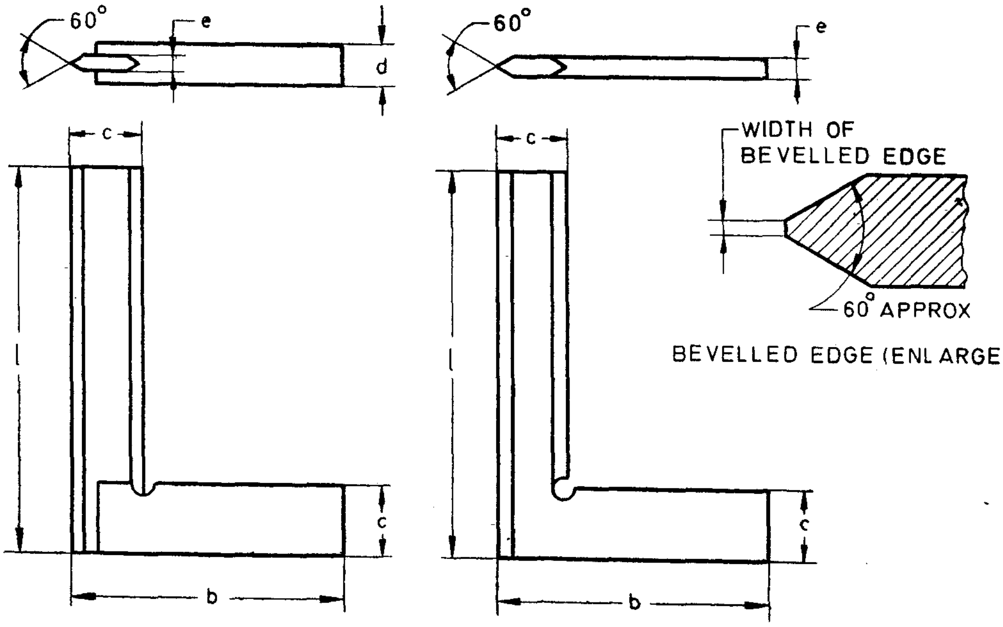
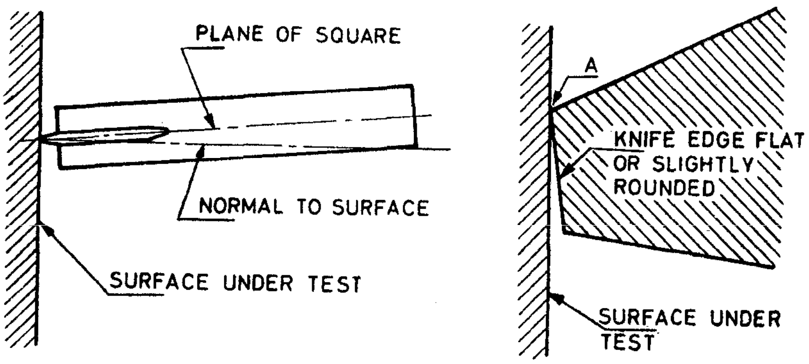


FIG. 3 BEVELLED EDGE SQUARE

Note — The operation of bevelling the edges of the blade of a square should be carried out with care, keeping in view the possibility of the square being used in practice with its plane slightly out of the normal to the surface under test as shown in Fig. 4. If the sharp edge A formed by the junction of the bevel and the reduced edge of the blade is not straight and/or laterally parallel with the plane of the square, the square will show erroneous results unless it is presented to the surface under test with its plane truly normal to that surface. Square with bevelled edge blades are unsuitable for testing cylindrical surfaces. For this purpose an ordinary square with flat-edged blade should be used since the cylindrical surface itself provides the necessary line contact.



ENLARGED VIEW OF CONTACT BETWEEN KNIFE EDGE AND SURFACE UNDER TEST

FIG. 4 USE OF BEVELLED EDGE AND SQUARE

8. Marking — The engineer's squares shall be legibly and permanently marked with the nominal length of the blade in millimetres, grade of accuracy, type, number of this specification and the manufacturer's name or trade-mark. The marking shall be done on a non-functional surface only.

8.1 *ISI Certification Marking* — Details available with the Indian Standards Institution.

9. Packing

9.1 Each square shall be protected against climatic conditions by coating with a suitable non-corrosive compound, wrapped in a non-absorbent paper and shall be supplied in suitable packings.

EXPLANATORY NOTE

This standard was first published in 1962 and subsequently revised in 1972. In the present revision most of the provisions given in the previous standard have been retained without change and only a few changes have been incorporated to bring it in line with BS 939-1962 ' Engineer's squares including cylindrical and block squares ' issued by the British Standards Institution and DIN 875-1975 ' Squares 90°, dimensions, technical conditions and delivery ' issued by Deutscher Normenausschuss.

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